Continuity

Limiting Value = Functional Value

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Continuity of a function at a fixed point A real function f is continuous at a point c if

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Note:-

a.) Left Continuous at a point

If $\lim_{x \to c^-} F(x) = F(c)$ L.H.S $= F^n\ Value$

b.) Right Continuous at a point

If $\lim_{x \to c^+} F(x) = F(c)$ R.H.S $= F^n\ Value$

c.) Continuous at a point

F^n is left as well as right continuous.

d.) Discontinuous at a point

If Function is not Continuous.

e) Removable and Non- removable discontinuous

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Real function at a point

Real function in an Interval

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Algebra of Continuous Functions

Suppose f and g are two real functions, continuous at real number c. Then,

Join Gro

- f + g is continuous at x = c.
- f – g is continuous at x = c.
- f.g is continuous at x = c.
- cf is continuous, where c is any constant.
- (f/g) is continuous at x = c, [provide g(c) ≠ 0]

Suppose f and g are two real valued functions such that (fog) is defined at c. If g is continuous at c and f is continuous at g (c), then (fog) is continuous at c.

If f is continuous, then |f| is also continuous.

Differentiability: A function f(x) is said to be differentiable at a point x = a, if
Left hand derivative at (x = a) = Right hand derivative at (x = a)

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1. Examine the following functions for continuity at the indicated point :

i) $f(x) = \begin{cases} x^3 + 3\,, x \neq 0 \\ 1\,, \quad x = 0 \end{cases}$ at x=0

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ii) $f(x) = x^3 + 2x^2 - 1$ at $x = 1$

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If $f(x) = \frac{x^2-1}{x-1}$ for $x \neq 1$ and $f(x) = 2$ when $x = 1$, show that the functions is continuous at x=1

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A functions f is defined as $f(x)=\begin{cases}\frac{x^2-x-6}{x-3}, & x \neq 3 \\ 5, & x=3\end{cases}$ show that f is continuous at x=3

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Is the function f defined by f(x)=$\begin{cases} x, if\ x \leq 1 \\ 5, if\ x > 1 \end{cases}$ continuous at

i) $x = 0$ ii) $x = 1$ iii) $x = 2$

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If the function f defined by f(x)=$\begin{cases} 3x+5, if\ x \geq 2 \\ x^2, if\ x < 2 \end{cases}$ continuous at x=2?

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Is the function f defined by $f(x) = \begin{cases} \frac{2x^2-3x-2}{x-2}, & if\ x \neq 2 \\ 5, & if\ x = 2 \end{cases}$, continuous at $x = 2$?

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If $f(x)=\begin{cases} kx^2+5 \\ 2, x>1 \end{cases}$, Find k so that f may be continuous at x=1

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If $f(x)=\begin{cases} 3x-8\ , x \leq 5 \\ 2k\ , x > 5 \end{cases}$ find k so that f may be continuous at x=5

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If $f(x)=\begin{cases}3x-4, 0 \leq x \leq 2 \\ 2x+\lambda, 2 < x \leq 5\end{cases}$, find λ so that f may be continuous at x=2

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Examine the following functions for continuity :-

i) $f(x) = \begin{cases} \frac{x}{sin3x}, When\ x \neq 0 \\ 3, when\ x = 0 \end{cases}$ at x=0

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ii) $f(x) = \begin{cases} \frac{Sin2x}{sin3x} \text{ , when } x \neq 0 \\ 2 \text{ , when } x \neq 0 \end{cases}$ at $x = 0$

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iii) $f(x) = \begin{cases} \frac{cos3x - cosx}{x^2}, if\ x \neq 0 \\ -4 \quad , \ if\ x = 0 \end{cases}$ at x=0

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If $f(x) = \begin{cases} \frac{x^2-25}{x-5}, & x \neq 5 \\ k, & x = 5 \end{cases}$, is continuous at $x = 5$, find the value of k

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Find the value of k so that the function

$$f(x) = \begin{cases} kx + 1 \text{ , } if\ x \leq 5 \\ 3x - 5 \text{ , } if\ x > 5 \end{cases}$$ is continuous at x=5

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1. Is the function f defined by f(x)=[x] Continuous at

i) x=0 ii) x=1 iii) x=$\frac{1}{x}$

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2. i) $f(x) = \begin{cases} x\ , if\ x \geq 0 \\ x^2, if\ x < 0 \end{cases}$ (NCERT)

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ii) $f(x)=\begin{cases} x+5, if\ x \leq 1 \\ x-5, if\ x > 1 \end{cases}$

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3.i) $f(x)=\begin{cases} 2x-1\ , if\ x<2 \\ \frac{3}{2}x, if\ x\geq 2 \end{cases}$

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ii) $f(x)=\begin{cases} sinx - cosx, & x \neq 0 \\ -1 & ,x = 0 \end{cases}$

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4.i) f(x)=|x|

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ii) $f(x)=|x-5|$

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5. i) $f(x)=\frac{x^2-25}{x+5}$

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ii) $f(x)=\frac{1}{x-5}$

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6.i) $f(x)=\begin{cases} \frac{sin2x}{x}, if\ x>0 \\ 2\ , \quad if\ x\leq 0 \end{cases}$

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ii) $f(x)=\begin{cases} \frac{x}{|x|}, x \neq 0 \\ 0, x = 0 \end{cases}$

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7(i) $f(x)=\begin{cases} x^{10}-1, if\, x \leq 1 \\ x^2\, , if\ x > 1 \end{cases}$

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ii) $f(x)=\tan x$, $0 \leq x \leq \frac{\pi}{4}$

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8.(i) $f(x)=\begin{cases} 2x+3, if\ x \leq 2 \\ 2x-3, if\ x > 2 \end{cases}$

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ii) $f(x)=\begin{cases} x^3-3, if\ x \leq 2 \\ x^2+1, if\ x > 2 \end{cases}$

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9. i) $f(x)=\begin{cases} \frac{x^4-16}{x-2}, & x \neq 2 \\ 16, & x = 2 \end{cases}$

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ii) $f(x)=\begin{cases} \frac{sin3x}{x}+cosx, x>0 \\ 4-3x, x\leq 0 \end{cases}$

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10. i) $f(x) = \begin{cases} 2x, & if\ x < 0 \\ 0, & if\ 0 \leq x \leq 1 \\ 4x, & if\ x > 1 \end{cases}$ (NCERT)

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ii) $f(x)=\begin{cases} x+2\,, x \leq 1 \\ x-2, 1 < x < 2 \\ 0\,, x \geq 2 \end{cases}$

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11. Find the value of the constant k so that the function f defined by

$f(x)=\begin{cases} kx^2, x \leq 2 \\ x-3, x>2 \end{cases}$ may be continuous.

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12. For what choice of a and b are the following functions continuous :

i) $f(x)=\begin{cases} -5, & if\ x \leq -1 \\ ax-b, & if\ -1 < x < 3 \\ 7, & if\ x \geq 3 \end{cases}$

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ii) $f(x)=\begin{cases} x^2, x \leq 0 \\ ax+b, x>0 \end{cases}$

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